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roots of (2) are easily found to be $x=1$, $x=2$, $x=3$, $x=4$. We have, therefore, the following four groups of values:

$$\begin{cases} x=1, & y=2, & z=3, & u=4; \\ x=2, & y=1, & z=4, & u=3; \\ x=3, & y=4, & z=1, & u=2; \\ x=4, & y=3, & z=2, & u=1. \end{cases}$$

Also solved by G. B. M. Zerr, J. Scheffer, and A. H. Holmes.

GEOMETRY.

308. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

Find the locus of O, if the differences of the squares of tangents from it to circles A, B, C are x^2, y^2, z^2, respectively.

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.; A. H. HOLMES, Brunswick, Maine; L. E. NEWCOMB, Los Gatos, California; and J. SCHEFFER, A. M., Hagerstown, Md.

Let (u, v) be the co-ordinates of the point O;

$(x-m_1)^2+(y-n_1)^2=R_1^2$, the equation of the circle A,

$(x-m_2)^2+(y-n_2)^2=R_2^2$, the equation of the circle B, and

$(x-m_3)^2+(y-n_3)^2=R_3^2$, the equation of the circle C.

Then $(u-m_1)^2+(v-n_1)^2-R_1^2=T_1^2$, the square of the tangent from O to A;

$(u-m_2)^2+(v-n_2)^2-R_2^2=T_2^2$, the square of the tangent from O to B;

$(u-m_3)^2+(x-n_3)^2-R_3^2=T_3^2$, the square of the tangent from O to C.

$\therefore 2(m_2-m_1)u+2(n_2-n_1)v+m_1^2+n_1^2-m_2^2-n_2^2+R_2^2-R_1^2=x^2 \ldots (1)$,

$2(m_3-m_1)u+2(n_3-n_1)v+m_1^2+n_1^2-m_3^2-n_3^2+R_3^2-R_1^2=y^2 .,. (2)$,

$2(m_3-m_2)u+2(n_3-n_2)v+m_2^2+n_2^2-m_3^2-n_3^2+R_3^2-R_2^2=z^2 \ldots (3)$.

Adding (1) and (3) and subtracting (2), we have $x^2+z^2=y^2$ or $y^2-x^2=z^2$, the former being the equation of a circle with a variable radius y, and the latter the equation of an equilateral hyperbola with a variable semi-axes z.

If x, y, and z are constants, the locus is a point.

309. Proposed by J. SCHEFFER, A. M., Kee Mar College, Hagerstown, Md.

To find the equation of Brocard's Ellipse, the sides b and c of the triangle being the axes of co-ordinates.

Solution by the PROPOSER.

Let AB be the axis of x, AC that of y, then the equation of any ellipse touching the three sides of the triangle is of the form $D^2y^2+4Bxy+E^2x^2+4Dy+4Ex+4=0$, where